

## INDEXER WITH SELF-POWERED CARRIAGE

### BACKGROUND OF THE INVENTION

#### I. Field of the Invention

5 The present invention relates generally to train  
positioning systems, particularly to systems for indexing  
a coupled string or trip of cars through a work station,  
one or more cars at a time during loading or unloading  
endeavors. More specifically, the present invention is  
10 directed to such a system which includes dog carriages  
having on-board drive systems to operate the carriages  
along a single tension chain. The system includes  
converging, diverging, separately-operated, horizontally  
extending cantilevered car engaging and propelling dogs  
designed to operate from one side against car bogey wheel  
15 frames.

#### II. Related Art

Trains, many containing 100 or more cars of  
identical or a variety of sizes, have long been  
acknowledged as desirable and efficient carriers of bulk  
20 raw materials such as coal, iron ore, limestone, various  
finely divided dry bulk agricultural products including  
grains, etc., and liquid or dry chemicals. These cars  
are typically filled from above and may be emptied using  
a rotary car dumper in the case of coal or iron ore.

25 Liquid bulk cargo is typically unloaded by connecting  
outlets to large hoses with associated pumping equipment  
and opening bottom drain valves. The cargo then being  
pumped into tanks or tank trucks located near the tracks.

Cars shipping bulk agricultural products are bottom  
30 emptied into stationary freight handling equipment such  
as chutes, conveyor handlers or the like. These cars may  
be provided with a number of spaced bottom discharging  
hopper bins or chutes accessing the main storage volume  
of the car enclosed by sliding discharge gates. These

are designed to be precisely positioned over dedicated recessed receiving facilities situated at fixed stations such as grain or coal bins and conveyors positioned beneath the railroad track.

5           In the bottom discharge operation, a connected train engine roughly positions one end of a string of cars to be unloaded close to the unloading facility. Because train engines are not well suited for indexing or precisely positioning individual cars or even sets of  
10       cars along the track, let alone precisely over individual bins, train positioning devices known as railroad car progressors or indexers have been built and operated at fixed stations.

          Railroad car indexers of the class of interest  
15       include at least one car engaging and propelling member or "dog" for engaging at least one railroad car in a string or trip of cars and moving the string a given distance along the railroad track. The engaging members often situated and operated along an auxiliary indexer  
20       track or guideway juxtaposed in parallel relation to the railroad track in the fixed receiving facility. Fluid operated actuators such as hydraulic cylinders or chains and sprockets driven by hydraulic or electric motors supply power for moving the dog and pulling the railroad  
25       cars. U.S. Patent Nos. 4,006,691, issued to Kacir et al, and 4,354,792, issued to Cornish, show train positioners that approach the train from alongside the track and including an engaging member arm which engages a car coupler from above.

30           It is known to provide a train positioning system having one or more carriages which include a pair of horizontally pivoting dogs mounted in opposed spaced relation and adapted to such that a first dog engages and moves a bogey frame in a first direction and a second dog

engages and moves a bogey frame in the opposed direction. Such a system is illustrated and described in U.S. Patent 6,267,059 to Brandt, a co-inventor in the present application.

5           It is also known to operate dog-carrying, train-positioning carriages using a reversing chain drive which includes an over/under or vertical sprocket drive system in which the gears and chain are at least partially enclosed to reduce exposure of the mechanism to the  
10 elements and the buildup of foreign materials. A system such as this is illustrated and described in U.S. Patent 6,553,916 B2 to Goldbeck, a co-inventor in the present application.

15           While these prior systems have met with success, a need has also existed to simplify carriage drive systems that move the carriages and the system that operate the dogs. The present invention provides a dog carriage with an on-board drive system that requires only a single strand of tension drive chain. Separate, direct dog  
20 operation is also provided.

#### SUMMARY OF THE INVENTION

          The present invention provides a reversing train positioning system for engaging and moving a railroad car or trip of cars by engaging a bogey wheel truck frame.  
25 The train positioning system includes a dog carriage having a drive motor mounted on the dog carriage which operates to propel the dog carriage back and forth along a single tension chain in a carriage guideway provided alongside a railroad track. In one embodiment, the  
30 carriage is supplied with electric power and hydraulic fluid from an attached flexible power track system which has a fixed end connected to a source of high pressure hydraulic fluid and a drain and a source of electric power and a free end attached to move with the carriage.

In an alternate embodiment, the hydraulic system is carried on the carriage and the track system supplies power only.

Each dog carriage also is provided with a pair of  
5 spaced, horizontally-pivoting dog members, each directly  
operated by a linear fluid actuator to pivot between a  
deployed, bogey wheel truck frame engaging position and a  
retracted or stored position. The dogs are preferably  
10 mounted in opposed spaced relation so that they can pivot  
toward each other and converge on a bogey frame from both  
sides, if desired. In one preferred arrangement, each  
pivoting dog is attached to the rod end of a double-  
acting hydraulic cylinder in a manner such that when the  
15 dog is fully deployed to push against the bogey wheel  
truck frame, the rod is fully retracted. In this manner,  
the force of the fluid retracting the cylinder controls  
the maximum force that can be exerted by the dog against  
a bogey frame. When the force needed to move a trip of  
20 cars exceeds the amount exerted by the cylinder rod end  
fluid, the cylinder rod is free to extend and the dog  
will be pushed out of the way without damage. The  
working pressure, of course, can be adjusted as desired.  
Proximity detectors or limit switches are provided to  
verify the position of each dog at all times and the dogs  
25 are preferably designed to operate in an entirely  
separate and independent manner.

Each carriage of the reversing train positioning  
system of the invention is also provided with a non-  
contact system for detecting the presence and location of  
30 a proximate bogey wheel truck frame. The detection,  
acquisition or hunting process proceeds with both dogs in  
the retracted position. The retraction of the dogs is  
verified by position verification devices prior to the  
initiation of the hunting mode. The appropriate dog can

then be deployed in a timely manner to engage the bogey wheel truck frame.

The drive motor is preferably a conventional reversing hydraulic motor with associated drive unit which operates a revolving output sprocket or gear which, in turn, positions the dog carriage along a single strand tension chain situated in the carriage guideway. Chain tension is maintained by a pair of pneumatic (reservoir fed) cylinders located at the ends of the guideway. The system is preferably charged with high pressure nitrogen at perhaps 1500 psi. The system is designed to operate generally with the cylinder rods fully extended to eliminate slack and to provide for the most accurate positioning. At least one of the cylinders is provided with a linearly adjustable mounting system such that the chain can be easily loosened for removal and installation and all slack thereafter removed. This adjustment may be accomplished utilizing a threaded adjustment member which operates in the manner of a large take-up or toggle bolt.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

In the drawings wherein like numerals depict like parts throughout the same:

Figure 1 is a front elevational view of a train positioner dog carriage in accordance with the invention with parts removed for clarity;

Figure 2a is a partial top view of a dog carriage as in Figure 1 with both dogs in the fully retracted position and some parts removed for clarity;

Figure 2b is a figure similar to Figure 2a with one dog deployed;

Figure 2c is a view similar to that of Figures 2a and 2b depicting the dog carriage with both dogs deployed;

Figure 3 is a fragmentary perspective view of a

train positioning system including a dog carriage as in Figure 2b with one dog deployed, but including part of a guideway and part of the flexible track supply system;

5 Figure 4 is a fragmentary view of part of the guideway of the train positioner of the invention showing a linearly adjustable cylinder mount;

Figure 5 is a schematic diagram of a drive chain tension control system in accordance with the invention; and

10 Figure 6 is a front elevational view of an alternate embodiment of a train positioner dog carriage in accordance with the invention with parts removed for clarity.

#### DETAILED DESCRIPTION

15 At the outset, in accordance with describing aspects of one or more embodiments of the invention, it should be noted that the detailed descriptions are intended by way of example and are not intended by way of limitation with respect to any part of the invention. The embodiments of  
20 the invention can be modified while remaining in keeping with the inventive concepts.

One important aspect of the train positioning or indexing system of the present invention is the simplification of the drive system from one requiring a  
25 fully circumferential chain system including multiple idler sprockets and other associated drive parts to one which operates along a single strand of tension chain utilizing only three vertical sprockets located very close to the drive motor. The single strand of tension  
30 drive chain is, for the most part, concealed within the railcar positioner guideway. This arrangement also reduces the exposure of operating personnel and others in the vicinity to moving parts as the motor and gears are mounted on and move with the carriage.

Figure 1 depicts a front elevational view of a dog carriage configured in accordance with the present invention. The carriage is shown generally at 20 which carries a motor housing 22 in which a hydraulic motor 24 (Figures 2a-2c) is mounted with a conventional associated drive unit and brake system 25 having an output shaft carrying an associated output sprocket 26 which may be mounted and keyed in a well known manner or it may be machined as an integral part of the output shaft itself as in the detailed embodiment. As shown in the drawings, the output sprocket or drive gear 26 is associated with a pair of idler gears or sprockets 29 and 30 which with sprocket or gear 26 carry a single strand tension chain 28 as shown in the schematic of Figure 5. As also shown in the schematic of Figure 5, the system includes a stationary cylinder 32 and an adjustably mounted cylinder 34, shown with corresponding respective piston rods 36 and 38 fully extended and attached as by clevis joints 40 and 42 to the single strand tension drive chain 28.

Chain tension control is maintained by closed systems associated with each of the cylinders 32 and 34. Thus, cylinder 32 is provided with a connected closed system pressurized reservoir 44 containing an amount of pressurizing gas which is preferably nitrogen. Likewise, cylinder 34 has a similar associated reservoir 46. The reservoirs 44 and 46 are connected to pressurize the rod end of the cylinders 32 and 34, respectively. These systems maintain a minimum amount of tension in the chain 28 of the reversible drive system.

Cylinder 32 is mounted in a fixed horizontal disposition as by pivot joint 48 connected by gusset 50 to a base member 52. Adjustable cylinder 34 rides on a base 54 and is attached at 56 to a threaded rod member 58 which extends through an opening in a plate member 60 and

is threaded on to an adjusting hex nut 62 such that the relative position of cylinder 34 may be adjusted laterally by rotating the nut 62 on the threaded member 58 in a well known manner to loosen the chain for removal and replacement and to make sure the rods 36 and 38 are in the fully extended positions for operation of the system at installation.

Rotation of the output sprocket or gear 26 in a desired direction then propels the entire carriage along the guideway as desired by moving the system along the chain 28. Any directional chain slack is taken up by the tension control systems automatically.

As best seen in Figures 2a-2c, the carriage also includes a pair of oppositely disposed bogey wheel frame engaging horizontally pivoting dogs 70 and 72, respectively mounted to pivot about shafts 74 and 76, respectively. The dogs 70 and 72 are mounted to rotate and converge toward each other when they are deployed. The dogs 70 and 72 include respective tail sections 78 and 80 which, in turn, are connected at respective pivot joints 82 and 84 to pivot rods 86 and 88 of respective fluid cylinders 90 and 92 which, in turn, have their cylinder ends pivotally mounted at 94 and 96. Figure 2a depicts both dogs in the fully retracted or stored position. Figure 2b depicts the dog 72 deployed and the dog 70 retracted and Figure 2c depicts both dogs deployed. Note that the rods 86 and 88 are fully retracted when the corresponding dogs 70 and 72 are fully deployed so that the corresponding dog pushes against a bogey frame, the corresponding cylinder provides a stop for the pivoting of the dog. Thus, dog 70 is designed to push to the right and dog 72, to the left. In addition, it is clear that, as shown, the dogs 70 and 72 operate separately and independent of each other.



Also mounted on the carriage 20 is a sensing device depicted by reference character 100 which may be any type of suitable proximity detecting or optical detection device which can be used to detect the presence of a bogey frame opposite the dog carriage 20. Thus, because standard dimensions are utilized in railway cars, the detector 100 can be used to detect either the frame itself or a corresponding wheel mounted on the bogey truck frame. Many such devices are well known and such units may be purchased and mounted on the system as desired. Signals from the detection unit 100 are used to control aspects of the operation of the dogs 70 and 72.

Figure 3 depicts a schematic view of the carriage 20 and includes one end of a guideway 108 in which the carriage runs. Figure 4 shows the opposite end of the guideway 108 and includes the adjustable cylinder system. Figure 3 further depicts the flexible track power or pickup system which includes a power track guideway in which a flexible articulated track 112 operates as the dog carriage 20 reciprocates along guideway 114. The articulated flexible track 112 contains a series of connected links which carry flexible electric power cable and supply and drain hydraulic hoses (not shown). Electricity and hydraulic supply fluid and return lines are supplied to the cable and hoses at a stationary end also not shown.

Figure 6 is a front elevational view of an alternate embodiment of a train positioner dog carriage in accordance with the invention that is substantially similar to that previously described except that the hydraulic system is carried on board the carriage as depicted by the large object 120. The hydraulic system, of course, as is well known, contains the sump or supply of hydraulic fluid, together with the requisite filters

and high pressure pump which connects to the pressurizing lines and includes connections for all return lines to the supply reservoir or sump. As indicated, these devices are known and, it is believed, need not be  
5 illustrated and further described in detail as they themselves do not form part of the present invention. The advantage of carrying the hydraulic system 120 on board the carriage, however, is an important aspect as it eliminates the requirement for hydraulic lines to be  
10 included in the supply track 112 which consequently needs only supply electric power to the system. The self-contained on-board system presents a definite operational and maintenance advantage over the use of connected fluid supply lines.

15 This invention has been described herein in considerable detail in order to comply with the Patent Statutes and to provide those skilled in the art with the information needed to apply the novel principles and to construct and use such specialized components as are  
20 required. However, it is to be understood that the invention can be carried out by specifically different equipment and devices, and that various modifications, both as to the equipment details and operating procedures, can be accomplished without departing from  
25 the scope of the invention itself.

What is claimed is: